

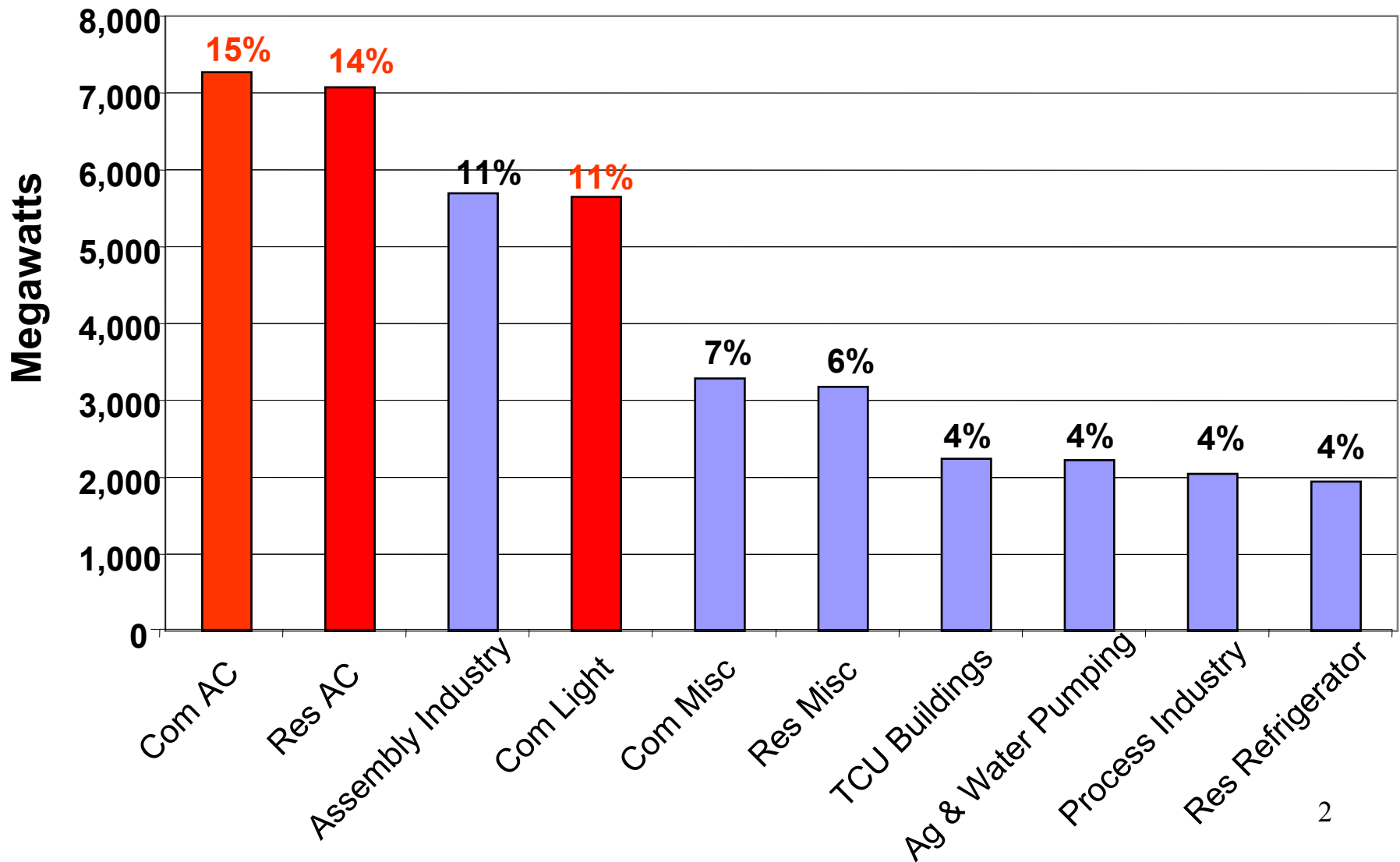
# **ADVANCED METERS AND DYNAMIC PRICING IN CALIFORNIA: IMPLEMENTING A VISION FOR THE FUTURE**

*Presented at the Metering, Billing, and CRM/CIS Conference  
San Diego, CA*



William J. Keese, California Energy Commission  
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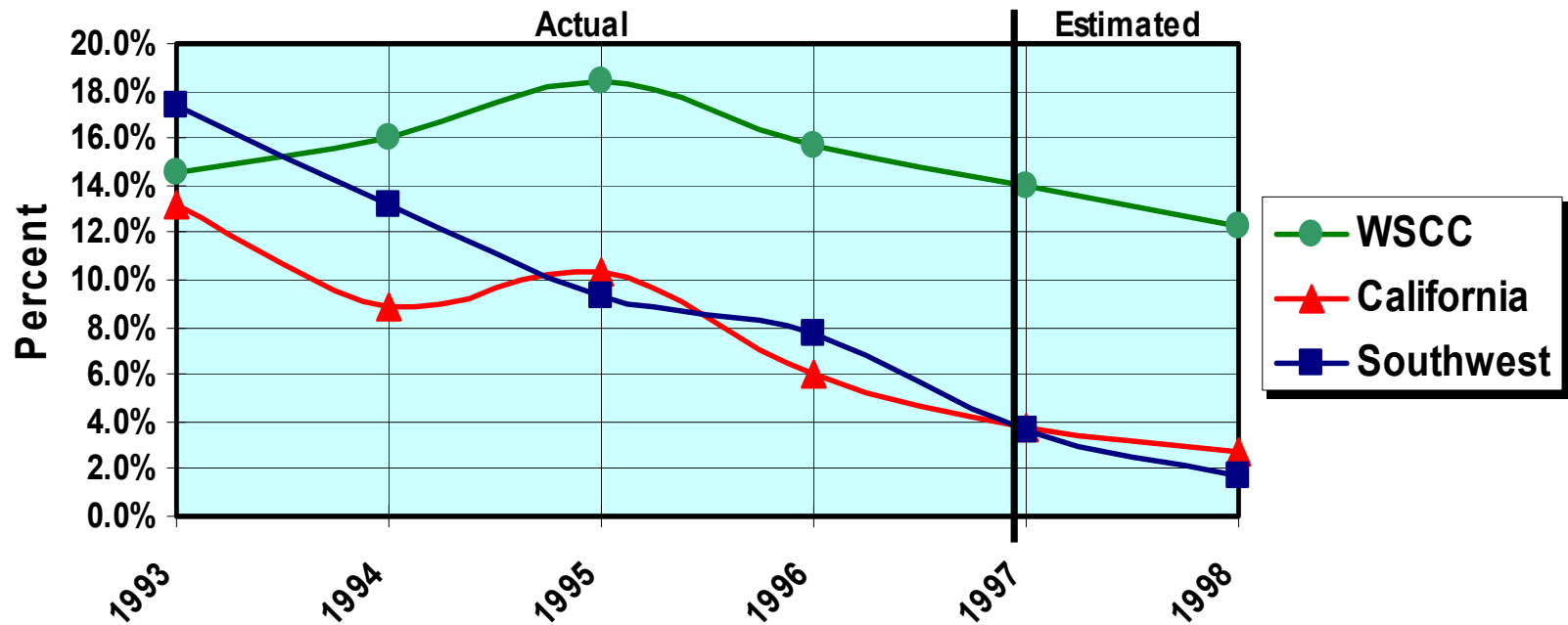
# Consumers Are Critical: Statewide Peak Demand (MW) by Sector and End-Use



# **Restructuring Debate: Someone Forgot to Include California Consumers**

- **End-use customers largely left out of restructuring debate.**
  - **Customers not given the proper tools to respond in a “competitive marketplace.”**
- **Interruptible rates offered to customers but in essence as a carrot to buying into the restructuring formula.**
  - **Most customers never thought they would actually get curtailed.**
  - **Many of these customers were severely impacted when the energy crisis began.**
  - **Customers were interrupted on a daily basis in early 2001 to avoid rolling blackouts.**
- **Most retail customers shielded from wholesale price spikes as the energy crisis took shape.**
  - **Customers energy demand was unaffected at the beginning of the energy crisis, exacerbating the problem.**
  - **Demand response would have helped!**

# What Happened: Non-Coincident Peak Demand Reserve Margins Declined in the 1990s



# California Response to the Energy Crisis

- Authorized \$32 million for 15-minute interval meters for 23,000 customers with loads exceeding 200 kW, representing 1/3<sup>rd</sup> of peak load.
- Offered \$21 million in grants, loans, and rebates for “enhanced automation.”
- Initiated programs and tariffs to promote demand response.

# California Vision: Dynamic Prices & Choice

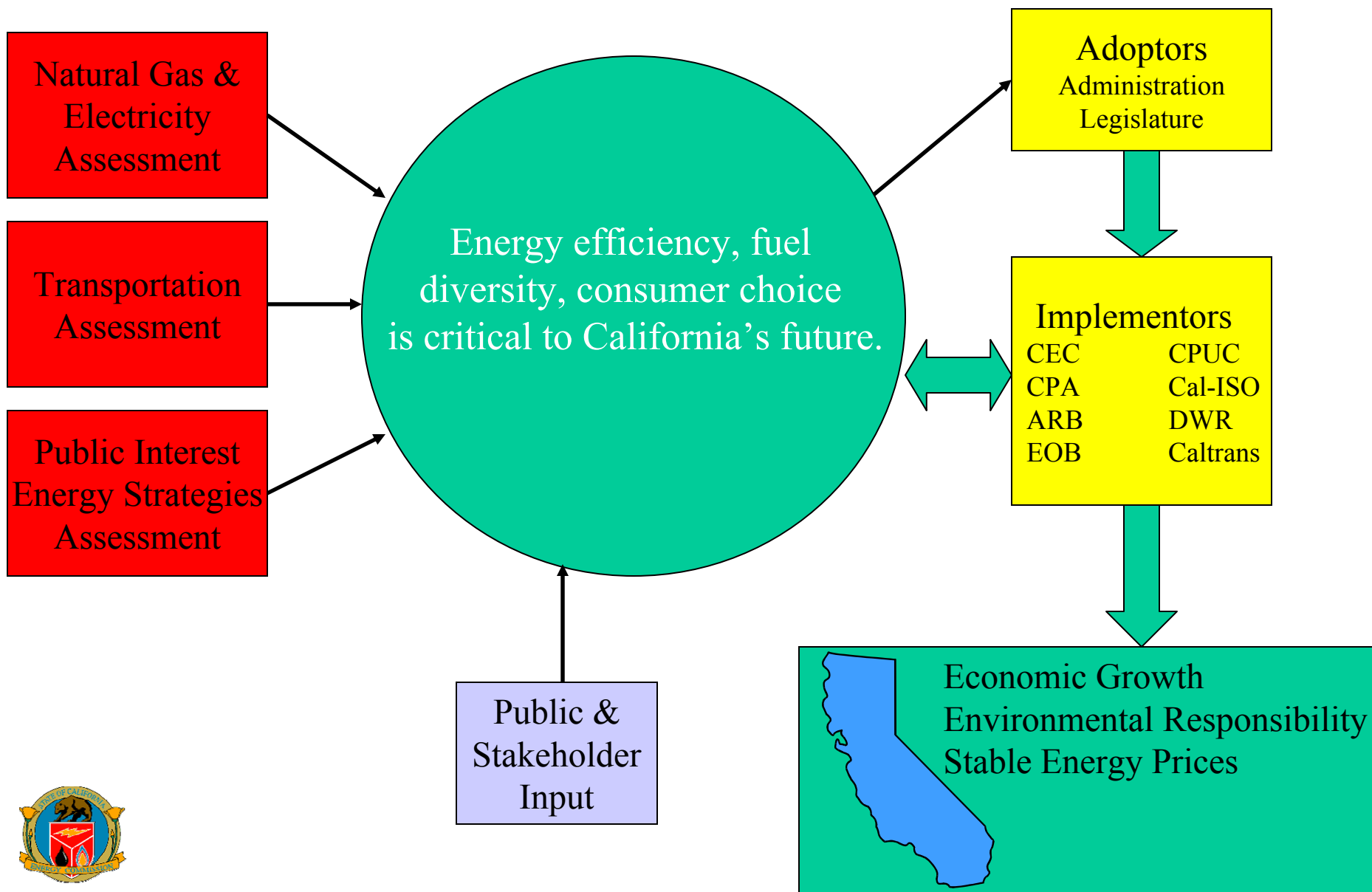
Demand Response is a  
Key Part of the California  
Energy Solution!

Advanced Metering is a Subset of  
Demand Response

Metering Vision: Offer time-of-use  
pricing or better if digital meters are  
available and the economics work for the  
customer.



# California's Energy Policy Includes Demand Response



# Pricing Provisions Being Considered in California

- **Time-of-Use (TOU)** is typically 3 time blocks published in advance for entire season.
  - Peak, Shoulder, Off-Peak
  - Cannot address unforeseen weather or equipment failures
- **Critical Peak Pricing (CPP)** is a high price imposed on a few days a year when energy is expensive or system conditions are critical or near critical
  - Non-CPP hours are less expensive as a result
  - Customer pays the critical price when invoked by the utility
    - day-ahead forecast of CPP offers added time for response
- **Real-Time Pricing (RTP)** is the hourly marginal cost of a kWh
  - Addresses hot weather, scarcity, or equipment failures
    - day-ahead forecast of RTP offers added time for response



# California Demand Response Activities

- Public Utilities Commission, Energy Commission, and California Power Authority initiated a joint proceeding during the summer of 2002 on advanced metering, demand response, and dynamic pricing
  - CPUC R.02-06-001
  - CEC 02-Demand Response-01
- Objective of the OIR
  - To address in a comprehensive manner demand flexibility to:
    - Enhance system reliability
    - Reduce power purchase and individual consumer costs
    - Protect the environment.

# Pilot Tariff/Advanced Metering Program

- 2,400 smaller customers in pilot on a variety of tariffs to test interest and ability to respond to prices
- Comparing Flat, Time-of-Use, and Critical Peak Pricing
- Voluntary participation
- Preliminary results for July thru October 2003
  - Based on regression analysis
  - Results are preliminary and
  - “... estimates presented here should be used with caution” (page 2, Draft Report, Statewide Pricing Pilot Summer 2003 Impact Analysis, Charles River Associates)
    - Only four months of data
    - Prior research suggests customers will adapt demand response behavior over time

# Results of Summer 2003 Pilot Summer Analysis

- Initial results are very encouraging! TOU and CPP customers reduced their demand by 20% during the warmest summer afternoons in 2003.
- Impacts vary with appliance ownership. (Higher for households owning major electric appliances like central air conditioners, swimming pools and electric cooktops).
  - Average peak-period energy impact = -0.5 kWh
  - Impact with all 3 appliances = -2.1 kWh
  - Impact with none of the appliances = -0.3 kWh
- Energy conservation is evident with all rate treatments
  - CPP-F reduction in daily energy use = 5.7 percent
  - TOU reduction in daily energy use = 8.7 percent

# Results of Summer 2003 Pilot Summer Analysis

- Analysis of the summer 2003 data has yielded a wealth of useful statistical information on program impacts.
- The impacts are in line with prior information and put to rest the theory that California customers have already responded to higher prices and cannot respond any more.
- They also indicate that coincident peak demand responds as much as the energy consumption during the peak period.
- The experiment has yielded statistically significant estimates of price elasticities of demand that are in line with the empirical literature on time-varying rates.

# Research in Demand Response Technology

- California Institute for Energy Efficiency (CIEE)'s Demand Response Enabling Technology Development Program
  - Basic research in new technologies that meet "10/10" objectives: 10 times the capabilities, at 1/10th the cost.[\[1\]](#)
- Demand Response Program at LBNL (Lawrence Berkeley National Lab)
  - Technology demonstrations for large commercial and institutional buildings, looking at how building controls can be installed and optimized to automatically respond to price and system condition signals.
  - This project will become part of a new Demand Response Research Center being created at LBNL in 2005. Numerous other projects to develop and demonstrate DR technologies and programs are also being conducted.
- PIER is also beginning to fund other enabling technology development projects that relate to smart meter deployment.
  - Focus on meter network management, system integration, and control and communications.

# Adding Demand Response to Building Efficiency Standards

- Installing advanced meters depends on the CPUC, utilities, and local governing boards for the municipal utilities.
- On the customer side of the meter, the CEC intends on looking at requiring in Title 24 advanced thermostats that can receive signals from the utilities or ISO and adjust the temperature in a home or office when prices are very high or the electric system reliability is threatened.
- Incremental costs of requiring this is very small, especially in comparison to the huge costs of system outages and price spikes. It also is an essential complement to real-time meters, because smart thermostats will give customers the ability they need to respond to high prices and control their bills.
- Advanced thermostats will complement potential implementation of AMI (advanced metering infrastructure) by utilities.

# Concluding Remarks

- Price responsive demand will enhance the competitiveness of electricity markets.
- Our expressed goal is for the various demand response activities to reduce peak load by approximately 5% (2500 MW) by 2007.
- A direct link between wholesale and retail markets is essential.
- California plans to merge price-sensitive demand response programs with system emergency programs requiring instantaneous load response.

# For More Information...

- Regulatory Proceedings

- California Public Utilities Commission Rulemaking 02-06-001
  - <http://www.cpuc.ca.gov/static/industry/electric/demand/index.htm>
- California Energy Commission Rulemaking 02-Demand Response-01
  - <http://www.energy.ca.gov/demandresponse/documents/index.html>

- Recommended Reading:

- *Dynamic Pricing, Advanced Metering and Demand Response in Electricity Markets.*
  - Hewlett Foundation Energy Series Foundation monograph by Severin Borenstein, Mike Jaske and Art Rosenfeld, 9/02
  - <http://www.energy.ca.gov/commission/commissioners/rosenfeld.html>
- *How and Why Customers Respond to Electricity Price Variability: A Study of NYISO and NYSERDA 2002 PRL Program Performance*
  - Neenan, B., et.al., January 2003
  - <http://certs.lbl.gov/PDF/NYISO.pdf>